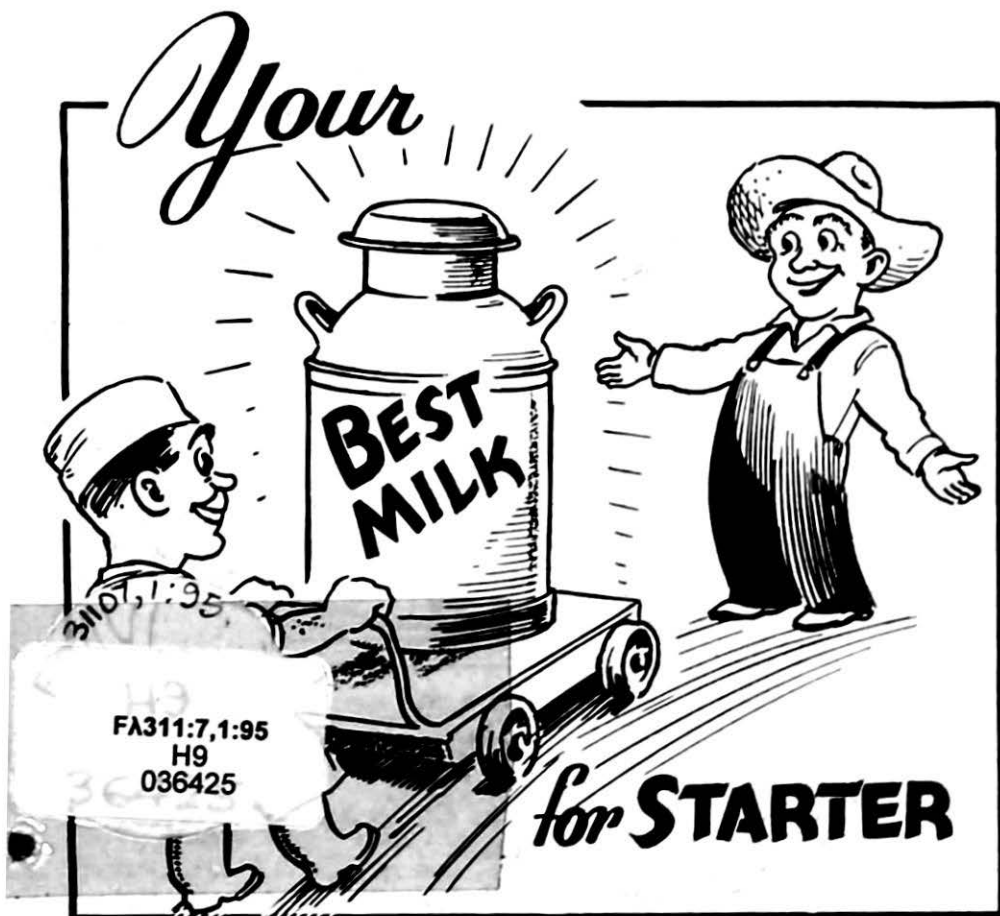


# How to Make Good Lactic Starter

W. V. Price

**L**LACTIC STARTER is the common name for the culture that is used for making Cheddar cheese, Cottage cheese, Cream cheese, Baker's cheese, sour cream, cultured buttermilk and sometimes, Brick cheese.

Good starter can be made without elaborate equipment but it does pay to have the best that the business can afford. If you want to know more about equipment you may turn at once to page 10.



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## What is a Good Starter?

**S**TARTER is sterilized milk which has been soured by the growth of countless millions of desirable, lactic-acid-producing bacteria. In good starter these bacteria are alive and ready to work. You can always tell a good starter because:—

### Good Starter

- is jelly-like before the curd is broken;
- it has a smooth, rich-cream consistency after it is thoroughly stirred or shaken;
- it usually has a slightly brown color caused by sterilizing;
- it has a clean, mild-acid taste and a pleasing odor;
- it never wheys off;
- it never shows bubbles of gas nor splits nor holes in the curd;
- it only takes 4 ounces to develop 0.70% acid in ten gallons of pasteurized milk held for 15 hours or less at 70°F.



Fig. 1. Seed starter in milk bottles is protected by a 5-inch square of parchment which is held down over the top of the bottle by a metal cup.

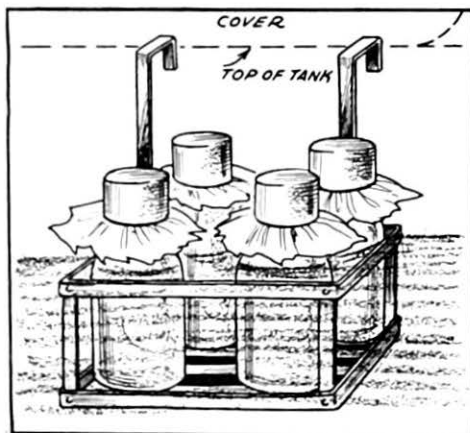


Fig. 2. This rack holds the bottles of seed starter for treatment. It hangs inside the tank as shown in Figure 3. The rack holds the bottles so the tops are above the water level.

## SEED STARTER is Always Carried by the Best Operators

**S**EED STARTER is the small amount of starter that is made each day in small, carefully protected containers. Seed starter is added to the sterilized milk to make bulk starter.

How to make seed starter is described on pages 4 to 9.

Seed starter, like seed corn, is a selected strain that produces such excellent results. Like seed corn, it is raised from wild seeds and this is best accomplished by growing it in a seed bed. Too much care cannot be used in making a good seed starter. *Unless the seed starter is right the bulk starter will be wrong.*

### BULK STARTER does the work

**B**ULK STARTER is the large quantity of starter that is carried in a starter vat or in milk cans. Bulk starter is added to the milk in the cheese vat for Cheddar cheese or Cottage cheese, or to pasteurized milk for making buttermilk, or to pasteurized cream for making ripened cream butter or Cream cheese.

How to make bulk starter is described on pages 9 and 10.

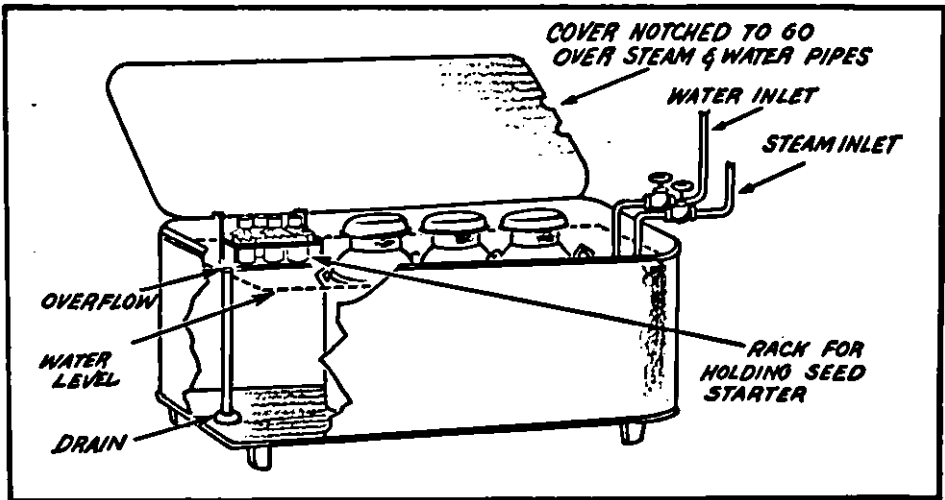


Fig. 3. Here is a steel tank with a cover; it is used for sterilizing, cooling, and holding milk, bulk starter, and seed starter at the desired temperatures. The cans and bottles are heated at the same time in flowing steam. Cold water is used for cooling. The overflow pipe keeps the water at the right level in cooling. The overflow pipe can be unscrewed by hand to drain the water from the tank. The rack of bottles of seed starter must be taken out of the tank and cooled in the air until they are just lukewarm before they can be put into cold water. Some equipment manufacturers now make this type of tank of stainless steel; their tanks have insulation, sealed covers, and noiseless heaters.

### SEED STARTER IS MADE THIS WAY

1. Select your best milk ----- see page 4
2. Put half a pint of milk in each of 4 pint bottles ---- see page 4
3. Cover the tops of the bottles ----- see page 4
4. Sterilize the milk in the bottles ----- see page 5
5. Cool the sterilized milk to 70° F. ----- see page 6
6. "Seed" the sterilized milk ----- see page 6
7. Ripen the seed starter at 70° F. ----- see page 7
8. Chill the seed starter to 60° F. or lower ----- see page 7

## Selecting the Milk for Seed Starter

USE your best milk for starter. Get it from the patron who is most dependable. Be careful!

*Milk for starter:—*

- should be absolutely fresh and practically without odor;*
- should stay blue in the methylene blue test for more than six hours;*
- should be really clean—not simply “cleaned” by filtering;*
- should come from healthy cows—never from inflamed udders.*

### Preparing the Milk for Seed Starter for Sterilizing

PLACE one-half pint of the selected whole milk in each pint bottle. Half a pint of good starter is plenty of seed for 200 pounds of bulk starter. It's a good idea to make at least three or four bottles, or as many as you need, so you can choose the best of the lot for your bulk starter.

Place a five-inch square of parchment paper on top of each bottle and crush it down, like a hood, to keep dust and bacteria away from the mouth and neck of the bottle.

Push a metal cup down over the top of the hood to hold the hood in place. An aluminum cup is best.

Notice how this is done in three easy steps in figure 4.

The next step is to sterilize the milk in these bottles.

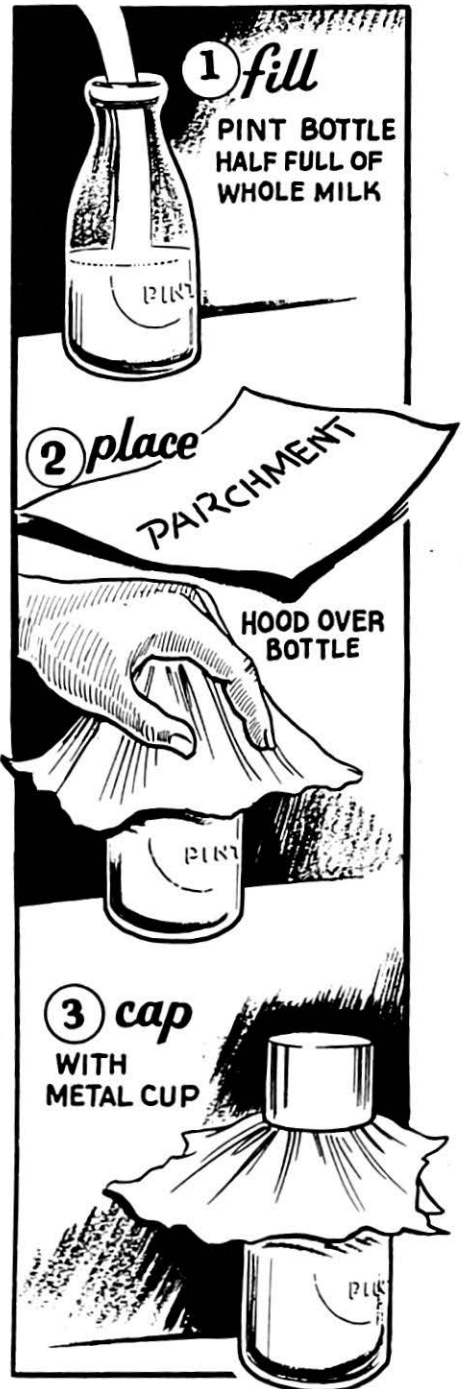


Fig. 4. Putting the milk in the bottle, covering the bottle top with the parchment paper hood and metal cup is the way to begin the making of high quality seed starter.

## Sterilizing Milk for Seed Starter

**M**ILK for seed starter must be heated in flowing steam for at least one hour. The milk should look slightly brown in color after this heat treatment. Milk heated in this way is practically sterile—it contains few, if any, living bacteria. One of the simplest pieces of equipment for doing this job is shown in figure 5.

If you want to use better equipment then turn to page 11 and see the "better facilities" that are recommended there.

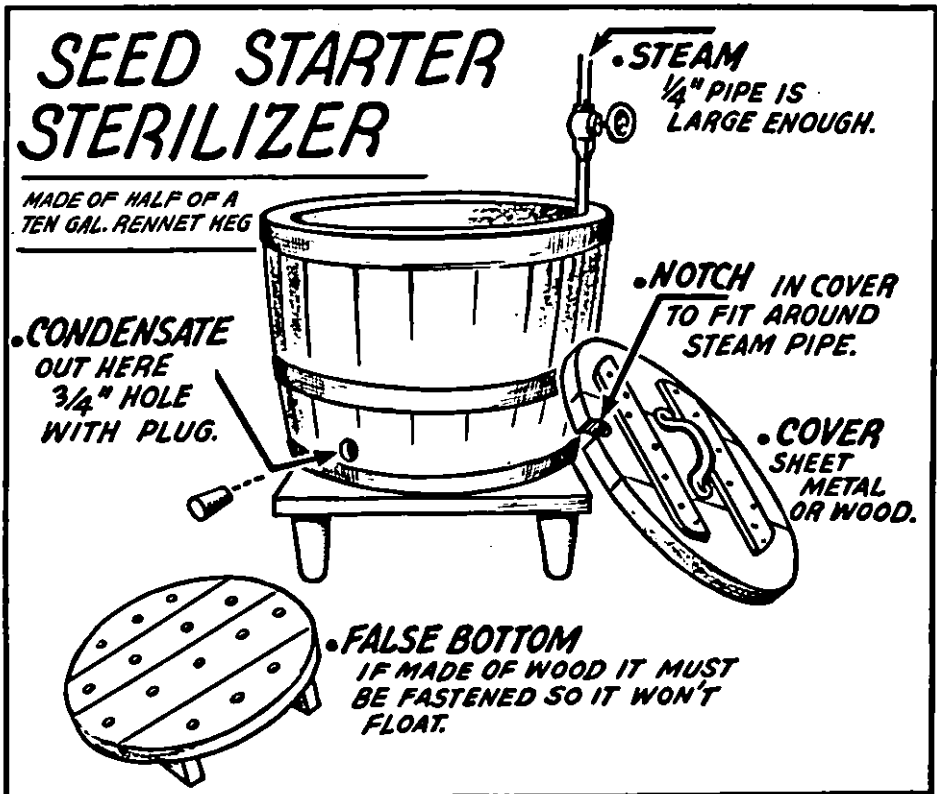


Fig. 5. You can make a gadget like this out of wood or metal. This one is made of half of a ten gallon rennet keg. You will need this, or more elaborate equipment, if you make your bulk starter in a starter vat like that shown in figure 14. You can use this gadget to sterilize the milk and then, later, you can use it as a water bath to hold the bottles of seed starter at 70° F. while acid is developing.

If you have no starter vat, then you may prefer to heat milk for seed starter and bulk starter at the same time by using the devices shown in figures 2 and 3.

## *Cooling the Sterilized Milk for Seed Starter*

**L**ET the bottles cool in the air and, when they are hand warm, set them in the sterilizer shown in figure 5, or in a clean pail of water at 60°F. The temperature of the water with the bottles in it finally comes to about 70°F; this is just the right temperature so hold it there.

If you want to be especially careful, you can sterilize an extra bottle containing water instead of milk. Treat it just like the other bottles. You can get an idea of the temperature of the milk in the other bottles by measuring the temperature of the water blank with your thermometer.

Don't be discouraged if you break a bottle the first time you heat and cool three or four of them. After you have used a bottle for starter it gets tempered to the heating and cooling and is better than a new bottle. With reasonable care bottles will last for many weeks. Pint bottles last better than quart bottles.

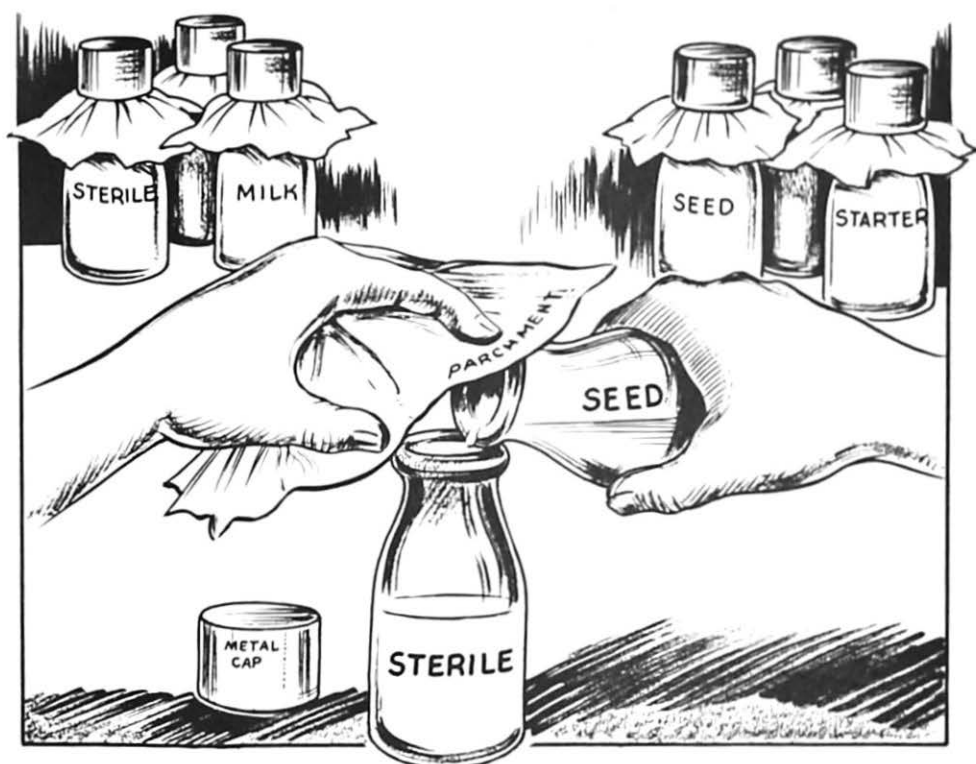
## *Seeding the Seed Starter*

**T**WO drops of seed starter added to one-half pint of sterile milk will usually make it thick in 16 hours; occasionally you may have to add a drop or two more, but adding too much is like putting too many cows in a pasture—neither the cows nor the pasture do well.

The best way to seed bottles of sterile milk is shown in figure 6.

### *Steps in Seeding*

- 1. Shake the bottle of seed starter until the curd is smooth and creamy.*
- 2. Remove the cup and paper hood from a single bottle of seed starter.*
- 3. Take the cup from the top of a bottle of sterile milk.*
- 4. With your left hand lift the paper hood of the bottle of sterile milk and hold it over the bottle top like an umbrella.*
- 5. Crowd the top of the bottle of seed starter under the paper umbrella and pour TWO DROPS into the sterile milk.*
- 6. Quickly replace the paper hood and then the cup on the bottle of seeded milk.*



*Fig. 6. This is a very important part of starter making. A drop of seed starter is being carefully poured into sterile milk under the protecting cover of the parchment hood. Each of the other bottles of sterile milk will be seeded in this same way by using a different bottle of seed starter for each one.*

### *Ripening the Seed Starter*

**T**HE seeded sterile milk must be held at 70°F. until it is thick. Higher temperatures spoil the flavor; lower temperatures slow the ripening. People and starters both like a living temperature of 70°.

A simple way to keep the bottles of seeded milk at the right temperature is to place them in plenty of water at 70°F. Keep the water level just slightly above the level of the milk in the bottles. The seed starter sterilizer shown in figure 5 is very good to use for this purpose and it should be used if a starter can is used for bulk starter.

The sterile milk usually thickens about 16 hours after it is seeded; it is then ready to use as seed starter. If you are not ready to use it at once, put it in a cold place where it will be chilled to 60°F. or below. This chilling lengthens the active life of the seed starter.

Just before you use the seed starter shake it until it is smooth and creamy so that you can measure it out drop by drop and so that it can be mixed thoroughly with the milk to be seeded.

The family tree of your seed starters will look like figure 7. *There are simpler ways of carrying starter but none of them is so safe.*

# SEED PURCHASED FROM LABORATORY

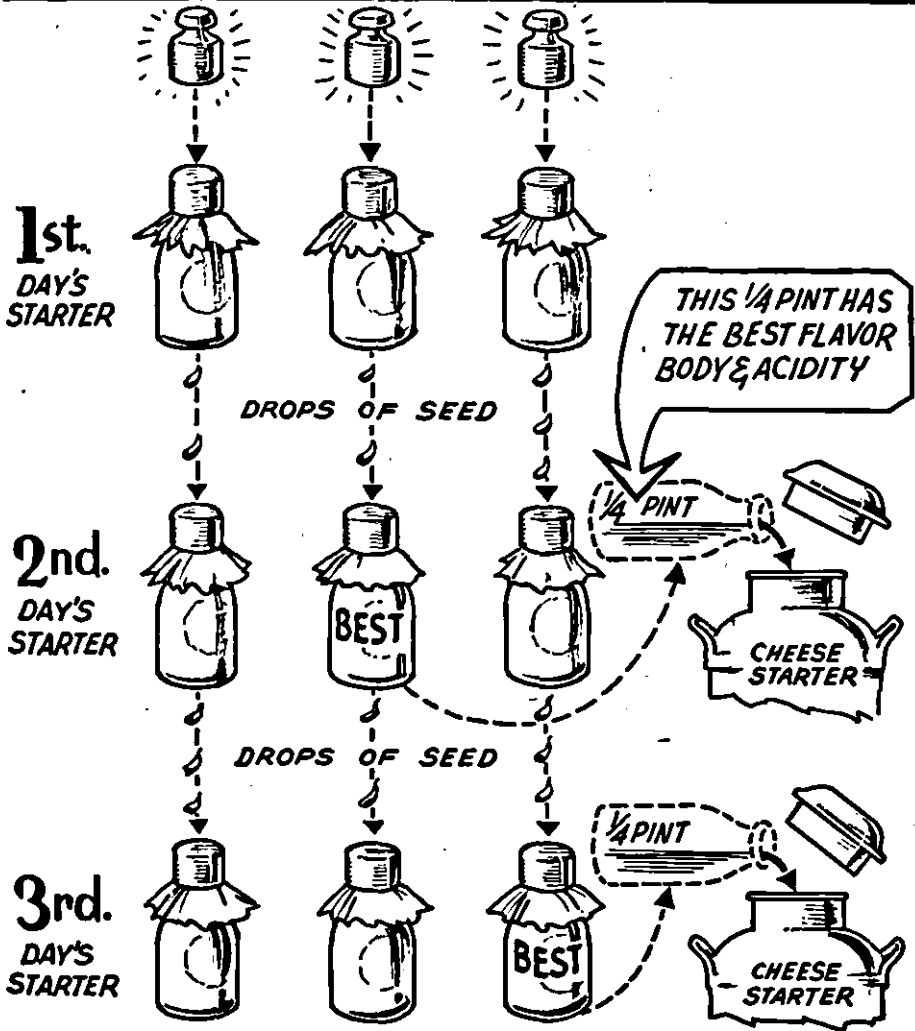


Fig. 7. THE FAMILY TREE OF GOOD STARTER

This shows how a few drops from a bottle of seed starter transferred each day to a new bottle of sterile milk becomes the next day's seed starter. After the seeding of the sterile milk is done then the best bottle of starter is used to seed the cheese starter for the next day. This is the "family tree" of a good starter.

## Where to get your first Seed Starter

IT'S important that you get the best possible seed for your starter; when you buy it ask for a "lactic culture". You can buy it in small bottles from any one of a number of commercial laboratories. Write the Dairy Department, University of Wisconsin, Madison, for a list.

You can buy seed starter in either the liquid or the powder form from commercial laboratories. The liquid starters, when fresh, require no special



treatments; seed starters or cultures in the powder form should be handled first according to the special instructions of the manufacturer which will be found wrapped around every bottle.

Never depend on your neighbor for seed starter *unless* he is following these methods of carrying starter and will let you carry home an *unopened* bottle of seed starter.

Now you are ready to make bulk starter.

### BULK STARTER IS MADE THIS WAY

1. Select your best milk ----- see page 4
2. Heat it to 185° F. or more for at least 30 minutes -- see page 9
3. Cool it to 70° F. ----- see page 9
4. Select your best seed starter ----- see page 9
5. Add one-quarter of a pint of seed starter to each 10 gallons of the heated milk ----- see page 9
6. Ripen the bulk starter at 70° F. ----- see page 10
7. Chill the bulk starter to 60° F. or lower ----- see page 10

### *How to Heat Milk for Bulk Starter*

**B**ULK starter is made in milk cans or starter cans. Skimmilk or whole milk is selected for its high quality. It is heated to not less than 185°F. and held at that temperature for at least 30 minutes. Heating to 200°F. for 60 minutes is desirable but not essential when a separate seed-starter is used. Use only a sterile thermometer to check these temperatures. You can sterilize a thermometer in a strong solution of chlorine or quaternary ammonium compound.

Cool the milk to 70°F.

### *Seeding the Bulk Starter*

**S**ELECT the best of your seed starters for seeding your bulk starter for tomorrow. Make your selection *after* you have transferred the seed starter itself into the sterile milk for tomorrow's seed starter. Making your selection *after* you have transferred the seed starter prevents contamination of the seed. Now you have another good reason for making several bottles of seed starter—you need to use only the best.

Use one-quarter of a pint of seed starter for ten gallons of sterile milk for bulk starter. Each bottle of seed starter contains one-half pint so pour out half of it into the bulk starter milk. Don't try to measure it in a graduate, that might contaminate it; just hold your thumb on the outside of the bottle at the half way level and pour out what you need. The small error you may make by careful estimating will not show any marked effect on the ripening of your bulk starter.

## *Ripening the Bulk Starter*

**H**OLD the seeded milk at 70°F. for about 16 hours until it thickens and gets an acidity of 0.70%. It is then ready to use. If it develops more than 0.70% acid before you can use it then you can use less seed starter the next time or you can add the seed starter to the heated milk later in the day. If the acidity is lower than 0.70% when you are ready to use it then you can use more seed starter the next time or you can add the seed starter earlier in the day.

If you are not ready to use your bulk starter when it gets the right acidity you should stir it and cool it to 60°F. or below.

The most successful scheme of carrying seed starter and using it for bulk starter is shown in figure 7.

## **BETTER FACILITIES FOR MAKING STARTER**

### *Space*

**A** SPECIAL room for making seed starter may be an excellent investment in large operations. Such a room should be of the most sanitary construction. Tile walls and floors and stainless steel shelves and tables are ideal. Only the equipment necessary for carrying starter should be in the room. The air should be forced into the room through a filter and there should be enough air pressure in the room so that the air will flow out of the door when it is opened.

In a cheese factory the vats for bulk starter must be tightly covered to prevent contamination and should be located in a room separate from the cheese vats and whey separator. This precaution is followed when there is danger of contaminating starter with bacteriophage.

Bacteriophage, or "phage" as it is usually called, is present in many factories or in the milk supplied to them. Phage destroys bacteria in starter so the best way to protect starter is to isolate the starter making operations as completely as possible. In New Zealand some factories have actually built starter laboratories in separate small buildings.

### *Equipment*

**M**ORE elaborate and expensive equipment for carrying starter is justified (1) when large amounts of starter must be made each day; and (2) when the smooth routine of large scale operations involving many men must be maintained. "Good facilities" and "better facilities" are both listed in tables 1 and 2. Table 1 shows the equipment for making seed starter; table 2 shows equipment for making bulk starter.

**TABLE 1. EQUIPMENT FOR MAKING SEED STARTER**

Equipment	Good Facilities	Better Facilities
Starter container.....	One-pint milk bottles	500 ml. Pyrex Erlenmeyer glass flasks (see figure 8)
Container covers.....	5" Parchment squares and aluminum cups (see figures 1 and 2)	4" Parchment squares and Pyrex beakers, (see figure 8)
For heating.....	Steam bath (see figures 3 and 5)	Pressure cooker and heater, or Autoclave (see figures 9 and 10)
For cooling.....	Water bath (see figures 3 and 5)	Stainless steel water bath with drain and hot and cold water connections. (see figure 11)
For seeding.....	No special equipment—pour seed from bottle to bottle (see figure 4)	No special equipment—pour seed from flask to flask. (see figure 12)
For ripening.....	Water bath (see figures 3 and 5)	Incubator with temperature controls to keep a uniform 72°F. (see figure 13)
For chilling.....	Water bath (see figures 3 and 5) and 50°F. storage	Mechanical refrigerator

**TABLE 2. EQUIPMENT FOR MAKING BULK STARTER**

Equipment	Good Facilities	Better Facilities
Containers.....	Milk cans made of stainless steel, aluminum, or well-tinned metal	Stainless steel, insulated, starter can. (see figure 14)
For heating.....	Steam bath (see figure 3)	Steam connections to starter can.
For cooling.....	Water bath (see figure 3)	Cold water connections to starter can.
For ripening.....	Water bath (see figure 3)	Well-insulated starter can
For chilling.....	Water bath (see figure 3)	Refrigeration connections to starter can.

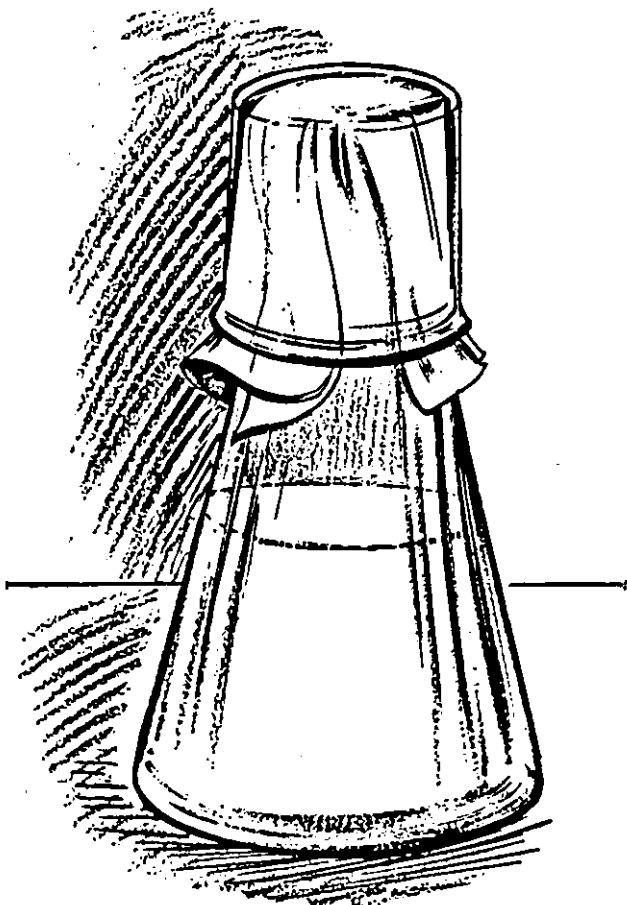


FIG. 8

Seed starter carried in a Pyrex flask, as shown in figure 8, is protected by a square of parchment paper held in place by a Pyrex beaker. The small neck opening in the flask gives added protection from contamination. Pyrex glass can be heated and cooled quickly.

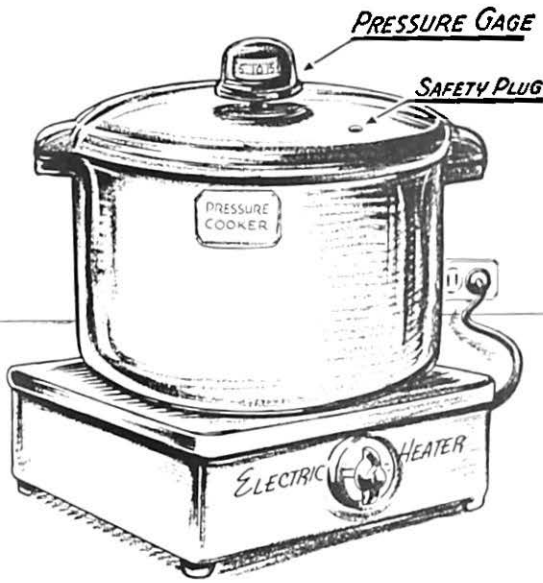


Fig. 9

A pressure cooker like that in figure 9 is an excellent piece of equipment for any good laboratory but is especially useful in a well-equipped small laboratory. Heating milk in Pyrex flasks in the pressure cooker for 20 minutes at 15 pounds pressure will sterilize the milk.

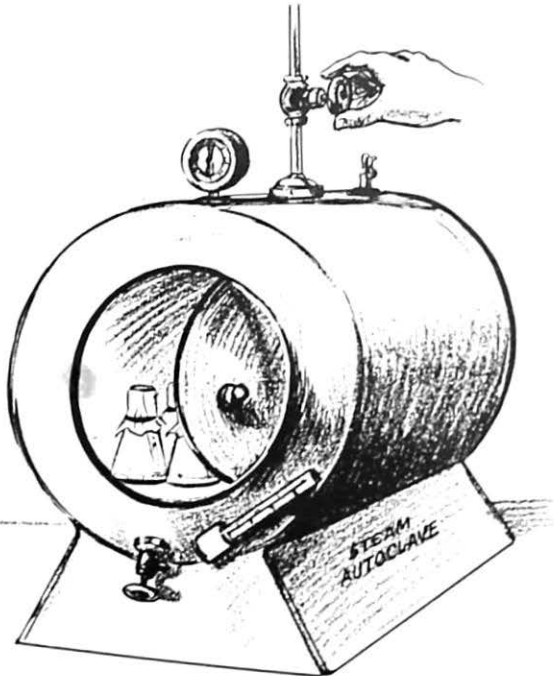


Fig. 10

An autoclave as shown is a piece of equipment that a well-equipped bacteriological laboratory must have. It is ideal for sterilizing milk for seed starter. Milk is sterilized in this machine by heating it for 20 minutes at 15 pounds of steam pressure.

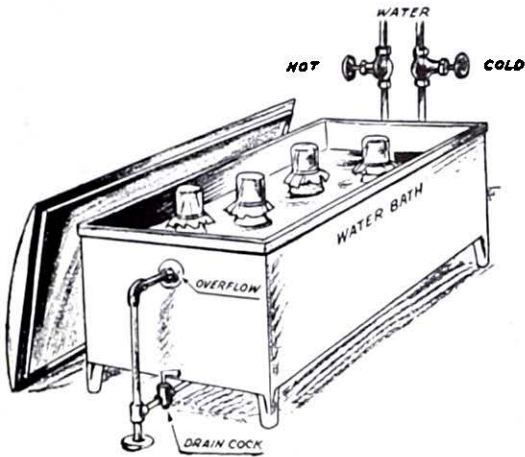


Fig. 11

A water bath connected with hot and cold water with an outlet to the drain provides a simple, quick way to adjust the temperature of Pyrex flasks or bottles of sterile milk. Such a bath is shown in figure 11.

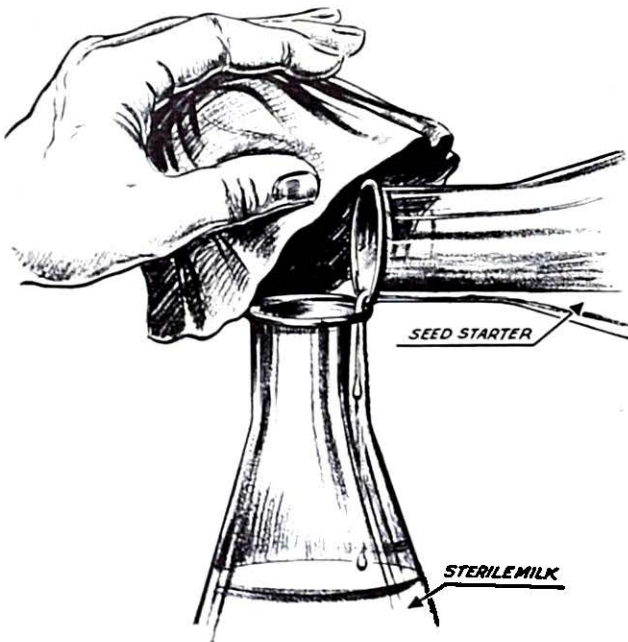


Fig. 12

The same technique illustrated in figure 6 can be used in handling the Pyrex flasks, as shown in figure 12. The small openings in the flasks decrease the chances of accidental contamination.

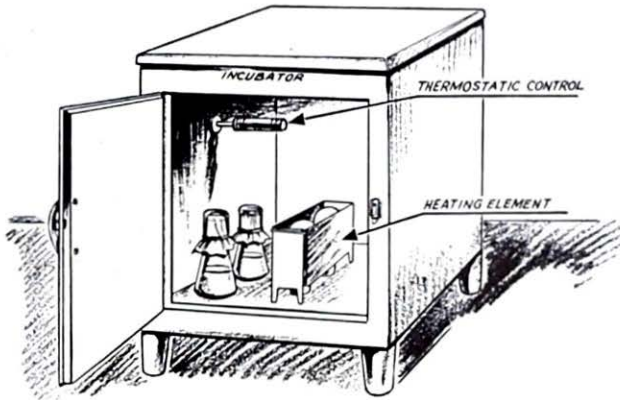


Fig. 13

An incubator that is electrically heated and has automatic temperature control is an excellent investment. Such a machine is shown in figure 13. It must be placed in a cool room where the temperature is below 70°F. or else some other provision for cooling must be made. At least one incubator is made with an ice box attached to help keep the temperature at 70°F.

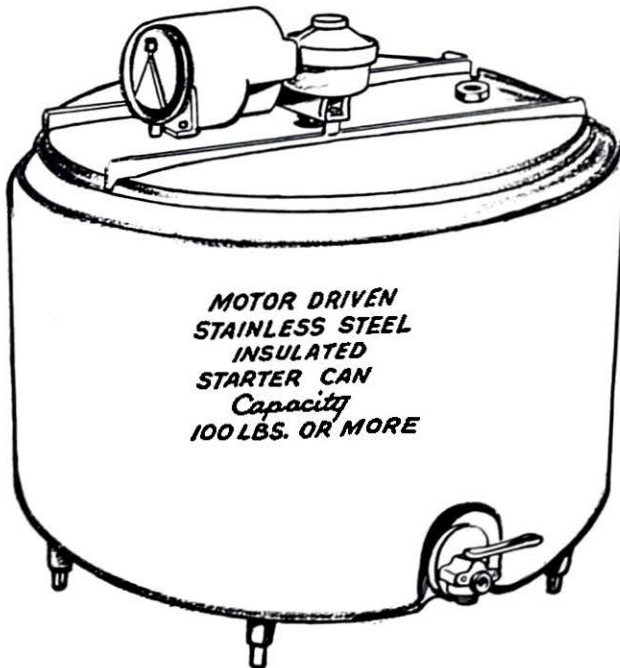


Fig. 14

A starter can, sometimes called a starter vat, is a convenience for making bulk starter. Every prosperous factory deserves to have one. It should be made of stainless steel, should be well insulated, and should be connected with steam and cold water. Large factories, where starter must be held several hours after it is ready to use, should have a means of cooling it by mechanical refrigeration.

## *A Careful Starter Maker Will—*

- always carry a seed starter;*
- never taste or smell the seed starter until after the sterile bottles of milk have been seeded for the next day;*
- always examine the curd in the bottles for signs of contamination like wheying off or gas formation before breaking the curd;*
- always select the best seed starter for seeding the milk for the next day's bulk starter;*
- always test the acidity of seed starters AFTER they they have been used for seeding purposes;*
- always steam the bottles of milk for seed-starter until they develop a slight brown tinge of color;*
- always try to have 0.70% acid in the bulk starter and in the seed starter when they are ready to use;*
- always cool the seed starter to 60° F. or below as soon as it thickens;*
- always cool the bulk starter to 60° F. or below as soon as it develops 0.70% acid;*
- ALWAYS BE AS CLEAN AS A SURGEON WHILE HANDLING STARTER.**

Published and distributed under Act of Congress, May 8, 1914, by the Agricultural Extension Service of the College of Agriculture of the University of Wisconsin, Warren W. Clark, Associate Director, the United States Department of Agriculture cooperating.